

Claims

1. An apparatus for improving the flow characteristics of injection moulding or extrusion material, the apparatus comprising:

a flow path through which a material to be injection moulded or extruded passes
5 in use, and

ultrasonic vibration means arranged for direct contact with material passing through the flow path in use, for directly vibrating the material as it is being injected or extruded.
- 10 2. An apparatus as claimed in claim 1, in which the vibration means comprises an ultrasonic probe.
3. An apparatus as claimed in claim 2, in which the ultrasonic probe is arranged for direct contact with material in the flow path.
- 15 4. An apparatus as claimed in claims 1 to 3, in which a portion of the vibration means extends at least partially into the flow path for directly vibrating material in the flow path.
5. An apparatus as claimed in claims 1 to 3, in which the vibration means extends transverse to the longitudinal axis of the flow path, with an end portion of the vibration means arranged for direct contact with material passing through the flow path in use.
- 20 6. An apparatus as claimed in any preceding claim, in which the vibration means operates at a frequency of between 10 kHz to 50 kHz.
7. An apparatus as claimed in any preceding claim, in which the flow path is formed in a part of an injection moulding tool.

8. An apparatus as claimed in any preceding claim, in which the moulding tool has a fixed part that remains stationary relative to an injection barrel during the normal injection moulding process and a moving part which is adapted to move relative to the fixed part during the normal injection moulding process, and the flow path is formed in the fixed part of an injection moulding tool.
9. An apparatus as claimed in claim 7 or 8, in which the vibration means is mounted on the part of the moulding tool having the flow path.
10. An apparatus as claimed in any of claims 1 to 6, in which the flow path is formed in a die block of an extrusion apparatus.
11. An apparatus as claimed in claim 10, in which the vibration means is mounted on the die block.
12. An apparatus as claimed in any preceding claim, in which the vibration means is mounted on the apparatus using non-metallic seating means, to prevent metal-to-metal contact.
13. An apparatus as claimed in claim 12, in which the non-metallic seating means also provides a seal about the vibration means.
14. An apparatus as claimed in any previous claim, in which a seal is provided about the vibration means at a nodal point on the vibration means where little or no vibration occurs.
15. An apparatus as claimed in claim 14 when dependant on any one of claims 1 to 11, in which the seal comprises a metallic seal means.
16. An apparatus as claimed in any previous claim in which the vibration means comprises a sonotrode.

17. A method for improving the flow characteristics of a material being injected or extruded from an injection or extrusion barrel to a shape forming part, comprising the steps of injecting or extruding a volume of material through a flow path in an injection moulding or extrusion apparatus, in which material passing through the flow path is brought into direct contact with an ultrasonic vibration means as the material is being injected or extruded.
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18. A method as claimed in claim 17, in which the contact of the material with the vibration means occurs at a position between the injection or extrusion barrel and the shape forming part.